



Engineering for the Environment. Planning for People. $^{\scriptscriptstyle \mathsf{TM}}$



SAMPLING AND ANALYSIS PLAN CORRECTIVE MEASURES IMPLEMENTATION FORMER REFINED METALS CORPORATION FACILITY BEECH GROVE, INDIANA

Prepared for:
REFINED METALS CORPORATION
Beech Grove, Indiana



SAMPLING AND ANALYSIS PLAN CORRECTIVE MEASURES IMPLEMENTATION FORMER REFINED METALS CORPORATION FACILITY BEECH GROVE, INDIANA

Prepared for:

REFINED METALS CORPORATION Beech Grove, Indiana

Prepared by:

ADVANCED GEOSERVICES CORP. West Chester, Pennsylvania

Project No. 2003-1046-18 October 6, 2010 Revised May 25, 2011



TABLE OF CONTENTS

			PAGE NO.
1.0	Introduct	ion	D-1
	1.1	Sampling and Analysis Plan Organization	D-1
2.0	Project D	escription	D-2
	2.1	Project Background	D-2
3.0	Project C	Organization and Responsibilities	D-4
	3.1	Project Manager	D-5
	3.2	QA Official	
	3.3	QA Manager	D-5
	3.4	QA Scientist	D-6
	3.5	Field Technicians	D-6
	3.6	Analytical Laboratory QA Officer	D-6
	3.7	Analytical Laboratory Sample Custodian	D-7
4.0	Quality A	Assurance/Quality Control Objectives	D-8
	4.1	Precision	D-8
	4.2	Accuracy	
	4.3	Data Representativeness	
	4.4	Data Completeness	
	4.5	Data Comparability	
	4.6	Sensitivity	
	4.7	Procedures for Monitoring PARCC Parameters	
5.0	Samplin	g to be Performed	D-14
	5.1	Field XRF Screening	D-14
	5.2	Confirmatory Soil and Sediment Sampling	
	5.3	Stockpile Sampling	
	5.4	Air Monitoring	
	5.5	Sampling during Well Installation	
	5.6	Containment Cell Groundwater Monitoring	



TABLE OF CONTENTS (Continued)

			<u>PAGE NO.</u>	
	5.7	MNA Groundwater Monitoring	D-17	
6.0	Sample (Collection Procedures	D-19	
	6.1	Confirmatory Sample Collection	D-19	
	6.2	Stockpile Sampling	D-19	
	6.3	Soil Sampling during Monitoring Well Installation		
	6.4	Soil Sampling Decontamination		
	6.5	Groundwater Sampling Equipment		
	6.6	Groundwater Sampling Procedures		
		6.6.1 Synoptic Water Levels	D-24	
		6.6.2 Field Analyses		
		6.6.3 Purging Procedures		
		6.6.4 Sample Collection		
		6.6.5 Decontamination of Groundwater Sampling Equipmen		
	6.7	Field Sampling Documentation Procedures	D-29	
	6.8	Sample Containers and Preservation	D-30	
	6.9	Quality Control Samples		
		6.9.1 Duplicate Samples	D-31	
		6.9.2 Equipment Blanks		
		6.9.3 Matrix Spike Samples		
		6.9.4 Field Blanks		
7.0	Sample	Custody	D-35	
	7.1	Chain-of-Custody	D-35	
		7.1.1 Field Custody Procedures	D-36	
		7.1.2 Sample Labels		
		7.1.3 Chain-of-Custody		
		7.1.4 Transfer of Custody and Shipment		
		7.1.5 Custody Seals		



TABLE OF CONTENTS (Continued)

		PAGE NO.
7.2	Sample Designation	D-37
	7.2.1 Proposed Sample Identification System	D-37
7.3	Sample Handling, Packaging, and Shipping	D-38
7.4	Sample Preservation and Holding Times	
7.5	Laboratory Sample Custody Procedures	
8.0 Calibrat	ion Procedures and Frequency	D-41
9.0 Laborate	ory Quality Assurance Program	D-42
10.0 Data Re	eduction Validation and Reporting	D-43
10.1	Data Reduction	D-43
10.2	Data Validation Protocol	
10.3	Data Validation Reports	
10.4	Data Reporting.	
11.0 Interna	l Laboratory Quality Control Check Samples and Calculations	D-47
11.1	Laboratory Blanks	D-47
11.2	-	
11.3	Laboratory Control Sample	
12.0 Perform	nance and System Audits	D-49
12.1	Laboratory Audits	D-49
	12.1.1 Performance Evaluation Audits	D-49
	12.1.2 Technical System Audits	
13.0 Preven	tative Maintenance	D-51
13.1	Field Equipment	D-51



TABLE OF CONTENTS (Continued)

			PAGE NO.
	13.2	Laboratory Equipment	D-51
		Routine Procedures Used to Assess Data Precision, Accuracy pleteness	D-52
	14.1 14.2 14.3	Precision	D-53
15.0 C	orrecti	ve Action	D-55
	15.1 15.2 15.3	Field Sampling Corrective Action Laboratory Situation Corrective Action Data Validation QA Corrective Action LIST OF TABLES	D-56
TABL	<u>E</u>		
1 2 3	Data (ling Parameters and Quantitation Limits Quality Objectives le Containers, Preservatives and Holding Times LIST OF ATTACHMENTS	
ATTA	СНМІ	<u>ENTS</u>	
A B C	Data	America Laboratory SOP Validation Checklist Manufacturer Instructions	



1.0 INTRODUCTION

The Sampling and Analysis Plan (SAP) presented in this attachment provides the policies, procedures, organization, objectives, functional activities, and specific Quality Assurance/ Quality Control (QA/QC) procedures that shall be employed by Refined Metals Corporation (RMC), Advanced GeoServices Corp. (Advanced GeoServices), and the Remedial Contractor during sampling associated with the proposed Corrective Measures for the RMC, Beech Grove, Indiana site to ensure that the technical data generated during the sampling are accurate and representative. This SAP provides the Quality Assurance Project Plan components.

1.1 SAMPLING AND ANALYSIS PLAN ORGANIZATION

Section 1.0	_	Introduction
Section 2.0		Project Description
Section 3.0	_	Project Organization
Section 4.0		Quality Assurance/Quality Control Objectives
Section 5.0		Sampling To Be Performed
Section 6.0	_	Sampling Procedures
Section 7.0		Sample Custody
Section 8.0	_	Calibration Procedures and Frequency
Section 9.0		Laboratory Quality Assurance Program
Section 10.0	_	Data Reduction Validation and Reporting
Section 11.0		Internal Laboratory Quality Control Check Samples and Calculations
Section 12.0	_	Performance System Audits
Section 13.0	_	Preventative Maintenance
Section 14.0	_	Specific Routine Procedures Used to Assess Data Precision, Accuracy and
		Completeness



Section 15.0 – Corrective Action



2.0 PROJECT DESCRIPTION

2.1 PROJECT BACKGROUND

The Refined Metals Corporation (RMC) Beech Grove facility (Site) was the location of a secondary lead smelting and refining operation from 1968 through 1995. The general location of the site is shown on Figure 1 of the CM Design Report and a detailed plan of the Site is shown on Sheet 1 of the design drawings. During its operational life, the facility handled hazardous materials or hazardous wastes under the Resource Conservation and Recovery Act (RCRA). These primarily consisted of lead acid automotive and industrial batteries, and lead-bearing materials that were processed for lead recovery.

In accordance with the requirements of RCRA, the facility completed and submitted a RCRA Part A permit application. On November 19, 1980 the facility was granted approval to operate two hazardous waste management units under Interim Status: 1) indoor waste piles; and 2) outdoor waste piles. Facility documents also identify a surface impoundment (lagoon) as a RCRA permitted unit; however, it does not appear to have been included on the Facility Part A permit until after 1991. The Surface Impoundment was, and still is, used to collect and manage facility storm water runoff. See Sheet 1 of the design drawings for the location of the RCRA Hazardous Waste Management Units (HWMUs).

The former indoor and outdoor waste piles were removed when normal facility operations ceased. The site sat idle after December 31, 1995 except for the wastewater treatment system which remained in operation to collect and manage storm water runoff from the lagoon and other site areas. Between August 2009 through early-January 2010 all buildings and structures were decontaminated and demolished, with the exception of four pump houses and the lagoon which were decontaminated, but remain in operation for on-site storm water management. Decontamination and demolition activities were performed in accordance with the *Draft*



Decontamination and Demolition Plan (Advanced GeoServices March 4, 2009) and the Decontamination and Demolition Implementation Plan (Focus Contracting, June 8, 2009) both of which were submitted, reviewed and approved by the USEPA and IDEM. A summary report of the decontamination and demolition activities is being prepared on a parallel track with preparation of this CM Design submission and will be included as an attachment to the Corrective Measures Completion Report to be provided following completion of the Corrective Measures.

Throughout the decontamination and demolition process storm water continued to be collected, treated as appropriate, and discharged to the City of Indianapolis POTW. Storm water sampling performed after completion of site cleaning activities has demonstrated that storm water from the lagoon and cleaned surface areas of the site can be discharged without requiring pre-treatment. In an effort to reduce the hydraulic loading on the POTW, the City of Indianapolis has requested that RMC cease discharge of the clean storm water to the sanitary sewer following completion of decontamination and demolition activities. At this time RMC has submitted a request for a "No Exposure Certification for Exclusion from NPDES Storm Water Permitting" to allow surface discharge of the storm water currently sent to the POTW. If storm water currently sent to the POTW will be surface discharged, it will most likely be sent to the drainage ditch at the north end of the property using the existing system of pumps and internal conveyance piping. RMC is also requesting approval from the City of Indianapolis to continue storm water discharge to the POTW until appropriate approvals for surface water discharge can be secured.

Additional background information is provided in CM Design Report Section 2.0. Previous soil sampling is discussed in CM Design Report Section 4.0.



3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The overall responsibility for the project is assigned to Mr. Matthew Love of Exide Technologies, representative of RMC. In this capacity, Mr. Love is responsible for the overall performance of the project including ensuring that the project is conducted in accordance with the Consent Decree and the Corrective Measures (CM) Design Report. This includes confirming that the Contractor, the QA Representative, and the contracted laboratory all conduct its operations in compliance with the CM Design Report.

The remedial activities will be performed by a Contractor selected based on cost and qualifications.

Construction Quality Assurance (QA) oversight will be the responsibility of RMC. Construction Quality Assurance services are expected to be provided by Advanced GeoServices utilizing personnel experienced in construction and remediation projects.

While all personnel involved in an investigation and in the generation of data are implicitly a part of the overall project and quality assurance program, certain individuals have specifically delegated responsibilities. The Information Gathering activities will be performed by Advanced GeoServices, under the direction of RMC. The AGC personnel with quality assurance/quality control (QA/QC) responsibilities are the Project Manager, QA Official, QA Manager, QA Scientist, and the field technicians. For samples collected by AGC personnel and/or their subcontractors, the analyses of the samples will be performed by Test America in North Canton, Ohio. The laboratory retains the responsibility for analytical data quality assurance, however. Specific laboratory personnel with QA/QC responsibilities include the Laboratory QA Officer and Laboratory Sample Custodian.



When sampling activities will be conducted by the Contractor, the Contractor's personnel will be required to meet the enclosed requirements.

3.1 PROJECT MANAGER

The Project Manager is an experienced manager and technical professional who assists in the coordination of the CM, participates in major meetings and regulatory negotiations and provides upper level contact for the client. The designated Project Manager is Paul Stratman, P.E., P.G.

3.2 QA OFFICIAL

The QA Official will be experienced in construction and remediation projects. The QA Official will be responsible for verifying that the Contractor's Quality Control activities are implemented in accordance with the Final Corrective Measures Design, including the Construction Quality Assurance Plan (CQAP). The QA Official is also responsible for conducting the sampling components of the CQAP.

3.3 QA MANAGER

The QA Manager will work on all projects requiring the collection of data, and as such is not directly involved in the routine performance of the technical aspects of the investigations. The QA Manager's responsibilities include the development, evaluation, and implementation of the SAP and procedures appropriate to the investigation. Additional responsibilities include reviewing project plans and revising the plans to ensure proper QA is maintained. The QA Manager is also responsible for all data processing activities, data processing QC, and final analytical data quality review.



It is a major responsibility of the QA Manager to ensure that all personnel have a good understanding of the SAP, and understanding of their respective roles relative to one another, and an appreciation of the importance of the roles to the overall success of the program.

3.4 QA SCIENTIST

The QA Scientist has primary responsibility for analytical data validation and review. In this capacity, the QA Scientist will prepare data validation reports describing data usability and analytical QC problems encountered.

3.5 FIELD TECHNICIANS

Experienced AGC Field Technicians will conduct all sampling tasks to be conducted by AGC. Select sampling will be conducted by the Contractor. One of the Field Technicians will be designated as the Field Team Leader. Their responsibilities will include the documentation of the proper sample collection protocols, sample collection, field measurements, equipment decontamination, and logbook and CHOC documentation.

3.6 ANALYTICAL LABORATORY QA OFFICER

The QA Officer has the responsibility for maintenance of all laboratory QA activities and documentation. The laboratory's designated QA Manager has been included as part of the each laboratory's quality assurance manual (QAM). The QAM from Test America has been included as Attachment A.



3.7 ANALYTICAL LABORATORY SAMPLE CUSTODIAN

The Sample Custodian's responsibilities include ensuring proper sample entry and sample handling procedures by laboratory personnel.



4.0 QUALITY ASSURANCE/QUALITY CONTROL OBJECTIVES

Site activities performed by the project team at the Site will incorporate, but not be limited to, the QA/QC procedures established herein during the removal activities.

In combination, QA and QC represent a set of procedures designed to produce analytical data of known and acceptable quality. A useful distinction between QA and QC programs can be made as follows: the QC program ensures that all information, data, and decisions resulting from the investigation are technically sound and properly documented, while the QA program assures that the QC program achieve its goals.

Data Quality Objectives (DQOs) are quantitative and qualitative statements specifying the quality of the environmental data required to support the decision making process. Separate DQOs are designed for field sampling and laboratory analysis so that clear distinctions between any problems found in the system can be isolated with respect to cause. Conversely, the DQOs are also designed to provide an indication of the variability of the overall system. The overall QA objective is to keep the total uncertainty within an acceptable range that will not hinder the intended use of the data. To achieve this, specific data requirements such as detection limits, criteria for precision and accuracy, sample representativeness, data comparability and data completeness (PARCC) are specified below.

Project specific DQOs are provided in the QAPP.

4.1 PRECISION

Precision measures the reproducibility of data or measurements under specific conditions. Precision is a quantitative measure of the variability of a group of data compared to their average value. Precision is usually stated in terms of relative percent difference (RPD) or relative



standard deviation (RSD). Measurement of precision is dependent upon sampling technique and analytical method. Field duplicate and laboratory duplicate samples will be used to measure precision for project samples. Both sampling and analysis will be as consistent as possible. For a pair of measurements, the RPD will be used to evaluate precision. For a series of measurements, RSD will be used to evaluate precision. The total precision of a series of measurements can be related by the additive nature of the variances. Equations for RPD and RSD are presented in Section 14.1 of this SAP.

QC samples, including field and laboratory duplicate samples will be analyzed and used to monitor precision for this project. One field duplicate will be collected for every 20 soil samples. A matrix spike sample and laboratory duplicate sample will be collected at a frequency of one set per 20 samples per matrix. All duplicate results will be evaluated during data validation with respect to the applicable DQO criteria listed in Table 2, the QAPP and the Region V Standard Operating Procedure for Validation of CLP Inorganic Data (USEPA, 1993).

Precision will be evaluated for all lead analyses performed in this program using the results of field and laboratory duplicate samples.

4.2 <u>ACCURACY</u>

Accuracy is defined as the degree of agreement of a measurement or average of measurements with an accepted reference value. Accuracy measures the bias in a measurement system which may result from sampling or analytical error. Sources of error that may contribute to poor accuracy are:

- laboratory error;
- sampling inconsistency;



- field and/or laboratory contamination;
- sample handling;
- matrix interference; and
- preservation.

Equipment blanks, as well as matrix spike (MS) QC samples, will be used to measure accuracy for project samples. The field component of accuracy will be negligible if the sampling, preservation, and handling techniques described in this SAP are followed. Accuracy in laboratory methods and procedures will be evaluated by use of calibration and calibration verification procedures, and instrument performance solutions, at the frequency specified in the USEPA "Test Methods for Evaluating Solid Waste Physical/Chemical Methods," November 1986, SW-846 3rd edition for lead analyses. Accuracy is calculated using the equation presented in Section 14.2 of this SAP.

Field and laboratory blanks, matrix spike samples and LCSs will be used to measure accuracy for the project samples. Blanks will be used to evaluate whether laboratory or field procedures represent a possible source of contamination. Equipment blanks will be collected one per 20 samples. Matrix spike samples and laboratory duplicates will be analyzed at a frequency of one pair per 20 samples. LCSs will be analyzed at a frequency of one per matrix per 20 samples or per laboratory preparation batch, whichever is more frequent. Accuracy will be evaluated based upon blank and spiked sample results with respect to the applicable DQO criteria listed in Table 2 and the Region V Standard Operating Procedure for Validation of CLP Inorganic Data (USEPA, 1993).

The laboratory method and calibration blanks will be required to meet specific criteria for compliance as listed in SW 846 methodology.



In the data validation, all blank samples will be evaluated. The general procedure for assessing blank samples will be as follows:

- Lead results will be reviewed for all blank samples collected outside of HWMUs.
- Antimony, arsenic, cadmium, lead and selenium results will be reviewed for all blank samples collected inside of HWMUs.
- All analytes will be reviewed for blank samples for groundwater monitoring.
- All blank samples for which lead is reported above the MDL will be identified.
- If contaminants are not detected in any of the blank samples, the data will be reported unqualified for blank contamination.
- If contaminants are found in any of the blank samples, the sample concentration(s) will be reported in the data validation narrative and assessed according to the Region V Standard Operating Procedure for Validation of CLP Inorganic Data (USEPA, 1993).

4.3 DATA REPRESENTATIVENESS

Representativeness expresses the degree to which sample data represent the characteristics of the environment from which they are collected. Samples that are considered representative are properly collected to accurately characterize the contamination at a sample location. Therefore, an adequate number of sampling locations have been chosen, and the samples will be collected in a standardized method. Representativeness will be measured by the collection of field



duplicates. Comparison of the analytical results from field duplicates will provide a direct measure of individual sample representativeness.

Comparison of the analytical results from field duplicate samples will provide a direct measure of the representativeness of individual sample results. The RPDs of the field duplicate results will be compared to the project-specific DQOs as given in Table 2.

4.4 <u>DATA COMPLETENESS</u>

Completeness is defined as the percentage of data that is judged to be valid to achieve the objectives of the investigation compared to the total amount of data. Data gaps will be continuously addressed when/if they occur by systematic re-sampling, as needed. Deficiencies in the data may be due to sampling techniques, or poor accuracy, precision, and laboratory error. While deficiencies may affect certain aspects of the data, usable data may still be extracted from applicable samples. The level of completeness, with respect to usable data, will be measured during the data assessment process by comparing the total number of data points to the number of data points determined to be usable. A usability criteria of 90 percent has been set for this project. The equation used for completeness is presented in Section 14.3 of this SAP.

4.5 DATA COMPARABILITY

Comparability expresses the confidence with which one data set can be compared with another data set from a different phase or from a different program. Comparability involves a composite of the above parameters as well as design factors such as sampling and analytical protocols. Data comparability will be ensured by control of sample collection methodology, analytical methodology and data reporting.



4.6 <u>SENSITIVITY</u>

Analytical methods have been selected which can provide the DLs (sensitivity), accuracy and precision criteria defined for this project. Soil samples will be prepared according to USEPA's SW846 (USEPA, 1996) method 3050B, while all field and equipment blanks will be prepared according to SW846 3010A, both hot-acid digestion procedures. All samples will be analyzed using USEPA SW-846 Method 6010B (inductively couples plasma [ICP] spectroscopy), except for antimony, which will be analyzed using USEPA SW-846 Method 6020A.

Specific QLs are highly matrix-dependent and may not always be achievable. See Table 1 for parameters to be analyzed and the corresponding methods and DQO QLs.

4.7 PROCEDURES FOR MONITORING PARCC PARAMETERS

PARCC parameters will be monitored through the submission and analyses of various types of field and laboratory QC samples. These will include appropriate equipment blanks, laboratory method blanks, field duplicates, matrix spikes, and instrument performance solutions. See Table 2 for data quality objectives.

The frequency by which the field and laboratory QC samples will be prepared and submitted is specified in Section 6.9 of this SAP.



5.0 SAMPLING TO BE PERFORMED

This section presents and described the rationale for the post excavation screening, stockpile sampling, confirmatory sampling, sampling during monitoring well installation, Containment Cell groundwater monitoring and MNA groundwater monitoring and analysis procedures to be performed by the QA Representative during CM implementation.

5.1 FIELD XRF SCREENING

Confirmatory sampling is required to demonstrate that soil excavation activities have been successful. The number of confirmatory samples has been selected in accordance with the IDEM RISC Technical Guidance, Chapter 6. The specified number of bottom and sidewall samples is consistent with the minimum number of sample locations required therein. The use of the 10 ft x 10 ft grid with random selection of the grid nodes to be sampled is intended to ensure that the selection of sample locations is truly random. The 10 ft x 10 ft grid works well since even the smallest excavation area (350 sf) will have the required number of nodes. For larger excavation the specific nodes to be sampled will be selected using a random number generator.

During excavation activities within areas specifically designated for post-excavation confirmatory sampling, a portable, hand held XRF device will be utilized to aid in the vertical delineation, and in some cases horizontal delineation, of contaminated material exceeding the Post Remediation Goals (PRG) for the targeted site contaminants depending on the particular remediation area. XRF testing locations on the bottom of the excavation will be selected utilizing a 10 ft x 10 ft grid and a random number generator. The grid is applied as an overlay that begins ½ the grid width (in this project 5 feet) from reference sidewalls selected by the Technician at the time of sampling. The reference sidewalls will be perpendicular sidewalls that are readily defined based on excavation configuration and physical features. The minimum



number of nodes to be tested/sampled is identified on the Drawings (Drawings 6, 7, and 8). For the oddly shaped excavations, the Technician will attempt to get maximum the number of grid nodes in the bottom of the excavation. For an excavation such as ND1 or ND2 the Technician will treat the grid as being a single baseline along the centerline of the excavation.

Confirmatory samples will be collected from 0 to 6 inch depth increment in the non-HWMU areas and from the 0-6 inch and 6 to 12 inch depth increment within the HWMUs. Samples will be placed in plastic bags, homogenized and the screened with the XRF. Five separate readings will be obtained on each sample, the results recorded and then averaged. Twenty percent of the XRF samples will be submitted for laboratory analysis and the results utilized to develop a correction factor for the other XRF results. Additional detail regarding development of the correction factor is provided in CQAP Appendix A. Laboratory analyses of Site metals shall be performed using EPA Method SW-846 6010B, except for antimony, which will be analyzed using EPA Method SW-846 6020A.

Additional detail regarding XRF screening is provided in CQAP Appendix A. Manufacturer's instructions for a typical XRF unit are provided in Attachment C of this document.

5.2 <u>CONFIRMATORY SOIL AND SEDIMENT SAMPLING</u>

Confirmation soil samples in both HWMU excavations and non-HWMU excavations will be consistent with the general protocol established for soil samples. Materials will be homogenized by mixing in the plastic baggies for at least one minute prior to XRF testing. Samples destined for laboratory analysis will be analyzed for lead only in non-HWMUs and Sb, As, Cd, Pb and Se in HWMUs. Areas that require additional excavation after the initial confirmation samples have been collected will be identified with the excavation depth. The results of all soil samples,



including the XRF sampling results, XRF correlation samples, confirmation samples and duplicates will be entered into a computerized database.

The post-excavation confirmatory sampling program will be implemented by the QA Representative in areas to demonstrate attainment with the appropriate cleanup goals. A typical description of the XRF analysis is provided, but the actual XRF manufacturer instructions should be followed when performing the analysis.

The design and rationale for confirmatory soil and sediment sampling is provided in CQAP Appendix A. Additional detail regarding XRF sampling is provided in CQAP Appendix A.

5.3 STOCKPILE SAMPLING

During the course of the work, the Contractor will generate materials that may be clean relative to the remediation standards being applied to the project and suitable for reuse during restoration. The types of material will be primarily topsoil (stripped during construction of the containment cell and SWM basin), crushed concrete and masonry (resulting from demolition of remnant slabs, concrete pavements, structures and foundations). The work may also generate material suitable for use and structural soil fill or cap soil fill (Specification Section 02210) that the Contractor wishes to have sampled for use as "unrestricted" material. All such materials shall be segregated based on type in stockpiles not exceeding 500 cy and characterized.

These stockpile sampling requirements have been developed with the intent of providing representative concentrations of antimony, arsenic, cadmium, lead and selenium in material proposed for reuse as backfill during site restoration. Utilizing composite sampling compensates for variability within the pile. Limiting the amount of material (250 cy max) that can be represented by a composite helps ensure that wide variability is not missed by to few samples.



Characterizing the stockpiles prior to use as backfill will help ensure that materials exceeding the cleanup criteria area not used.

Stockpile characterization shall be performed using composite samples. Stockpile sampling shall be performed as described in Section 6.2.

The design and rationale for stockpile sampling is provided in the CM Design Report.

5.4 AIR MONITORING

Air quality on-site sampling and personnel sampling will be conducted by the Contractor and monitored by the QA Representative. This SAP is not intended to cover air monitoring.

5.5 SAMPLING DURING WELL INSTALLATION

As discussed in CM Design Attachment H, MNA Work Plan, during installation of monitoring wells CC-1 through CC-6, at least two (2) soil samples will be collected for chemical analysis from each boring. The data will be used for geochemical modeling, if needed. The one sample each will be collected from the unsaturated overburden soils and from within the proposed screen horizon in each boring utilizing split spoon sampling techniques. Soil samples will be submitted for laboratory pH and eH, target analyte list (TAL) metals, arsenic speciation (arsenite/arsenate), iron speciation (ferric/ferrous), total organic carbon and sulfate. Samples from the same depth/intervals will also be submitted for gradation (sieve and hydrometer analysis). The soil sampling proposed in conjunction with installation of the Containment Cell monitoring wells will provide information regarding chemical and physical character of the soil necessary for geochemical modeling.



5.6 CONTAINMENT CELL GROUNDWATER MONITORING

As discussed in CM Design Attachment E, Operation and Maintenance Plan, groundwater monitoring will be conducted at seven shallow groundwater monitoring wells. Containment Cell Groundwater Monitoring locations have been selected to provide ample coverage along the perimeter of the Containment Cell to detect a release of contaminants from the Containment Cell following completion of the CM through both individual groundwater results and groundwater trends over time. Wells CC-1 through CC-6 and MW-2 will be sampled at least once during CM implementation and once per quarter for seven quarters following the completion of CM implementation. Groundwater sampling will be performed semi-annually in the third and fourth years following completion of CM implementation and annually thereafter.

Groundwater samples will be analyzed for total and dissolved antimony, arsenic and lead, pH and total organic carbon. Field analysis will be conducted for pH, specific conductance, and turbidity. Antimony, arsenic and lead are being analyzed because they represent the inorganic contaminants of greatest concern associated with the proposed HWMU Closure and CM.

Additional detail regarding Containment Cell groundwater monitoring is provided in CM Design Attachment E, Operations and Maintenance Plan. The design and rationale for Containment Cell groundwater monitoring is provided in CM Design Report Section 5.5.1 and Operations and Maintenance Plan Section 2.6 and 4.2.

5.7 MNA GROUNDWATER MONITORING

Existing wells MW-1, MW-2, MW-3, MW-8, MW-9 and MW-12 will be utilized as part of the MNA sampling network. In addition, the proposed monitoring wells CC-1 through CC-6 will serve the dual purpose of monitoring the containment cell and being part of the MNA sampling



network. Groundwater sampling locations for MNA have been selected because they bound the MNA monitoring zone.

The MNA groundwater monitoring wells will be sampled beginning approximately one month following installation of the proposed containment cell monitoring wells. Sampling will be performed once every calendar quarter for 12 consecutive quarters with the first evaluation regarding future frequency performed after completion of the second year of monitoring (i.e., after 8 quarters). Monitoring will end when the sampling results demonstrate that the remedial goals have been attained for four consecutive quarters. If analysis after the first 12 consecutive quarters indicates increasing concentrations, RMC will continue quarterly sampling while evaluating the observed results and developing an alternate strategy for mitigating impacts.

During the first two quarterly groundwater sampling events, samples will be analyzed for total and dissolved arsenic and lead, sulfide, sulfate, nitrate arsenic speciation (arsenite/arsenate), iron speciation (ferric/ferrous), and manganese speciation (MnII/MnVII) for use in geochemical modeling. Beginning after the second quarterly groundwater sampling event, groundwater analysis will be limited to total and dissolved lead and arsenic, unless additional geochemical modeling is deemed appropriate. Field parameter readings to be recorded at the time of sample collection during all groundwater sampling events shall include temperature; pH; Eh; dissolved oxygen (DO); specific conductance and turbidity.

Additional detail regarding MNA sampling is provided in CM Design Attachment H, MNA Work Plan. The design and rationale for MNA groundwater monitoring is provided in CM Design Report Section 5.5.2; Attachment E, Operations and Maintenance Plan Section 4.3; and Attachment H, MNA Work Plan.



6.0 SAMPLE COLLECTION PROCEDURES

6.1 CONFIRMATORY SAMPLE COLLECTION

Prior to sampling, loose soil or debris will be removed from the area using a stainless steel spoon or shovel or disposable scoops. Sampling implements will include stainless steel trowels or disposable plastic scoops, hand augering devices, and plastic Zip-Lock® baggies. Field personnel will don a new, clean pair of disposable gloves prior to sampling at each location. All implements, if not disposable, shall be decontaminated between the collection of each sample using the protocol described in this SAP. During the collection of each sample, the physical characteristics of the soil materials shall be recorded. Samples will be thoroughly mixed in a plastic bag for at least one minute. The plastic bag containing the homogenized sample will be labeled and entered on the Chain of Custody. Table 3 of the QAPP identifies the minimum volume of soil required by the laboratory for sample analysis. As a general rule of thumb, the sampling Technician shall attempt to obtain at least 50 grams to ensure adequate sample volume for testing.

Field personnel will record the soil's physical characteristics, a description of the sample location and depth, the time period for each sample collection, surface conditions surrounding the sample location, and all pertinent meteorological information.

6.2 STOCKPILE SAMPLING

Material stockpiles shall be characterized utilizing composite soil samples. The number of composite samples required to characterize a stockpile will be dictated by the estimated size of the pile. Each composite sample shall be comprised of 4 aliquots collected at various locations around the pile.



A detailed description of the sampling procedures is as follows:

A. Estimate the volume of the stockpile. The number of composite samples required is dictated by the estimated volume, as follows:

<250 cubic yards

1 Composite Sample

250 to 500 cubic yards

2 Composite Samples

- B. Divide the stockpile into sections of equal volume based on the number of composite samples required. (i.e., piles <250 cy are treated as a single volume, a pile requiring 2 composite sample is divided in half). One composite sample will be collected from each section.
- C. Provide each stockpile with a distinct identification and record the information (including type of material and source area) in the field book.
- D. Evaluate the piles for consistency in the visual appearance (color, gradation, etc.) of the materials. Record any notable observations in the field book.
- E. Subdivide each section into four quarters of roughly equal volume.
- F. For piles that are determined to be relatively consistent (i.e. homogeneous) in visual appearance, collect 1 subsample (aliquot) from each quarter, biasing one sample towards the lower third of the pile, biasing another sample towards the upper third and collecting the remaining two samples from the middle third. In piles that are observed to be heterogeneous, utilize the quartering to dictate the distribution of subsamples around the pile but also target sampling to provide a



proportional representation of the various materials in the pile. Collect all subsamples from a depth of greater than one foot below the pile surface.

- G. Each aliquot in a stockpile shall have approximately equal volumes and shall be collected into a disposable aluminum tray. Remove large stones, sticks and vegetation. When sampling concrete rubble, the sampler should attempt to get a representative amount of the fines contained in the material after the crushing process and should remove those pieces larger than 1.5 inches.
- H. Homogenize the sample by mixing in the aluminum tray until the composite is visually uniform using a disposable scoop and/or gloved hand.
- I. Transfer an adequate volume of the composite sample to a glass or other approved sample container. Table 3 of the QAPP identifies the minimum volume of soil required by the laboratory for sample analysis. As a general rule of thumb, the sampling Technician shall attempt to obtain at least 50 grams of sample to ensure adequate sample volume for testing. Cap and label the container, wipe residual from the outside of the container and complete require chain of custody. Collect duplicate and MS/MSD samples, as required below. Discard the remaining volume of material onto the stockpile.
- J. Decontaminate reusable sample equipment following the procedures described below.
- K. Place a stake marked with the stockpile identification and date sampled in the pile. Inform the Contractor when sample results are received and the final designation/disposition of the pile.



6.3 SOIL SAMPLING DURING MONITORING WELL INSTALLATION

Field personnel will don a new, clean pair of disposable gloves prior to sampling at each location. All implements, if not disposable, will be decontaminated between the collection of each sample using the protocol described in this SAP. The soil material from the desired interval will be removed from the split spoon using a disposable scoop or decontaminated trowel. The sample will be placed in a plastic bag.

During the collection of each sample, the physical characteristics of the soil materials shall be recorded. Samples will be thoroughly mixed in a plastic bag for at least one minute. The plastic bag containing the homogenized sample will be labeled and entered on the Chain of Custody. Table 3 of the QAPP identifies the minimum volume of soil required by the laboratory for sample analysis. As a general rule of thumb, the sampling Technician shall attempt to obtain at least 50 grams to ensure adequate sample volume for testing.

Field personnel will record the soil's physical characteristics, a description of the sample location and depth, the time period for each sample collection, surface conditions surrounding the sample location, and all pertinent meteorological information.

6.4 SOIL SAMPLING DECONTAMINATION

The sampling methods prescribed herein have been developed to minimize the possibility of cross-contamination. Those sampling implements which cannot be decontaminated effectively shall be disposed of between and after sample collection. Decontamination procedures for sampling equipment will be as follows:



- Remove particulate matter and surface films with tap water, Alconox and brush as necessary;
- Deionized water rinse:
- Nitric acid rinse (0.1 N);
- Deionized water rinse;
- Air dry (if possible); and
- Cover with plastic or wrap in aluminum foil if stored overnight.

Equipment blanks will be collected for decontamination QC. A description of the types and frequency of QC samples is included in Section 6.9. Any deviations from these procedures will be documented in the field logbook.

All derived wastes from each sampling event will be returned to the ground in the direct vicinity of the sample collection point.

6.5 GROUNDWATER SAMPLING EQUIPMENT

The following equipment will be used for Containment Cell groundwater monitoring and MNA sampling:

- Low-flow bladder pump and control box;
- Flow through cell;
- Generator and/or nitrogen tank;
- Laboratory supplied containers for the collection of metals samples;
- Ice cooler for sample storage and transport;
- Ice;
- pH/temperature meter;



- Field Turbidity;
- Conductivity meter;
- Depth to water meter;
- Interface probe;
- Teflon® tubing; and,
- Disposable bailers.

6.6 GROUNDWATER SAMPLING PROCEDURES

The following sections describe groundwater sampling procedures for Containment Cell groundwater monitoring and MNA sampling. Well sampling is comprised of synoptic water level measurements, field analysis, well purge techniques, sample collection, and decontamination procedures as described in more detail below. Groundwater sampling will begin at the designated up-gradient monitoring well, then proceed to the next selected well with the lowest historical total metal concentration.

6.6.1 Synoptic Water Levels

Prior to all groundwater sampling events, depth-to-water will be measured in each well in general accordance with the American Society of Testing Materials (ASTM D 4750-97) procedures using an electronic water level indicator. The synoptic measurements will include the measurement of water levels and well depths in the monitoring wells in as short a time frame as possible to determine the piezometric surface across the Site. The field personnel will measure and record the water levels in the wells to the nearest 0.01 foot using the surveyed point at the top of the inner well casing for reference. Measurements will be repeated at each well until two consecutive readings are within 0.01 feet. Total depths will also be measured and recorded in each well after (to avoid suspension of settled solids) each sampling event to



evaluate whether any silting of the well has occurred between sampling rounds. Water level measurements will be collected following IDEM Guidance Documents titled Collecting Static Water Level Measurements and Developing Ground Water Flow Maps. At the time of gauging the field technician will also make any notations regarding the condition of the wells (including unsecured, broken or missing locks).

6.6.2 Field Analyses

During Containment Cell groundwater monitoring, field measurements that will be performed during well purging will include pH, specific conductivity, and turbidity. During MNA sampling, field measurements that will be performed during well purging will include pH, eH, specific conductivity, temperature, dissolved oxygen (DO), and turbidity. Measurements will be collected by inserting the appropriate probe in a closed non-dedicated plastic container (flow-through-cell) that is rinsed with deionized water prior to purging the well. Turbidity samples will be collected from the flow through cell outflow.

Calibration of the instruments will be completed at the beginning of each sampling day, checked in the middle of the day, and as otherwise necessary based on the functioning of the meters and equipment. Each meter will be field calibrated in accordance with the manufacturer's specifications and appropriate calibration solutions. All calibrations will be recorded in the field log. Field calibration procedures at a minimum will include the following:

• Calibration of the field instruments will be performed by trained technicians prior to the mobilization of equipment to the Site. All the instruments will be calibrated as specified by the manufacturer. Standard solutions will also be checked to determine stability and operating conditions. All results of field calibrations and measurements will be maintained in bound field logbooks at least



daily when the instrument is in use. The recorded calibration information will include date and time of calibration results.

- pH meters will be calibrated according to the manufacturer's instructions prior to each use and will, at a minimum, consist of two standard buffer solutions (pH 4, 7, or 10) obtained from chemical supply houses. The pH values of the buffers will be compensated for the temperature at which the pH sample is measured. Verification checks will be completed at least once per day using a standard solution. The verification check results must agree within ±0.05 pH standard units or re-calibrations will be performed.
- All temperature measurements will be measured using a field thermometer and recorded to ± 0.2 °C.
- Dissolved oxygen meters will be calibrated to ambient air conditions.
- Specific conductance meters will be calibrated prior to each use using a potassium chloride solution (1,000 μmhos) prepared by a qualified laboratory or chemical supplier.
- Turbidity meters will be calibrated daily prior to use by a minimum of two standards of known turbidity as prepared by the manufacturer of the instrument.

 These solutions should bracket the levels found in the groundwater.



All calibration procedures performed will be documented in the field logbook and will include the date and time of calibration, name of the person performing the calibration, reference standards used and instrument readings. If equipment fails calibration or equipment malfunction is noted during calibration or use, the equipment will be tagged and removed from service.

6.6.3 Purging Procedures

Sampling procedures will include water level measurements, calculation of well volumes, purging, and sampling activities. The following step-by-step procedures are in adherence to the EPA Region IX groundwater sampling protocols for low flow pump purging and sampling, which are based upon the method of Puls and Barcelona (EPA/540/S-9S/504). If a bladder pump cannot be inserted into a well due to bent riser piping, then a peristaltic pump will be used.

Step 1	Measure depth-to-water of every well at the Site.
Step 2	Calculate one well volume of the screened or open interval.
Step 3	Lower the low-flow pump to the mid-point of the screened interval.
Step 4	Calibrate meters.
Step 5	Begin to purge well. USEPA recommends a purge rate of 200 to 300 milliliters/minute (ml/min). The purge rate should not exceed the recharge rate (i.e., less than 0.3 feet of draw down from the static water level).
Step 6	Measure purging parameters at a minimum of one per well volume or every 3 to 5 minutes. Measurements will be collected via flow through cell for pH, temperature, specific conductivity, and DO. Turbidity will be

D-29



measured at the outflow of the flow through cell every 3 to 5 minutes. All measurements will be recorded in the field logbook.

- Step 7 After conductivity and temperature have stabilized to within 3% over three readings, pH readings differ <0.1 standard pH units, and turbidity measurements differ within $\pm 10\%$, sampling can begin after the flow-through cell is disconnected.
- Step 8 Using the well purging pump, the flow rate will be reduced to 100 ml/min and the unfiltered sample will be collected out of the discharge line. The date and time of the sample collection will be recorded in the field logbook.
- Step 9 Using the well purging pump, the flow rate will remain at 100 ml/min and a disposable 0.45 micron in-line filter will be place at the discharge line. The filtered sample will be collected at the discharge end of the in-line filter. The date and time of the sample collection will be recorded in the field logbook. Filtering the samples in-line, as proposed, with disposable filters will reduce sample agitation, exposure to the atmosphere, and decontamination concerns.
- Step 10 Following groundwater sample collection, measure depth-to-bottom of every well at Site.

Purge water will be collected and containerized in a drum. The pump and sampling equipment will be decontaminated before and between each well.



6.6.4 <u>Sample Collection</u>

Groundwater samples will be collected using the low flow pump or peristaltic pump and tubing at a rate of 100 ml/min with the flow-through cell disconnected. Groundwater will be collected directly into laboratory prepared bottles. As shown in Table 3, filtered groundwater samples will be collected in one-liter HDPE bottles that are preserved with nitric acid to a pH value of less than 2 standard units. All other samples will be collected in glass or HDPE bottles with the appropriate preservation. Immediately following sample collection and labeling of bottle, the sample will be placed in an ice cooler to maintain sample at 4° C.

6.6.5 Decontamination of Groundwater Sampling Equipment

The pump will be disassembled and components will be decontaminated in the following manner:

- Alconox and water wash:
- Potable water rinse;
- Nitric acid rinse (10% solution);
- Distilled water rinse; and,
- Air dry and store pump in plastic.

To prevent possible contamination from sampling equipment, all non-dedicated sampling devices will be decontaminated. Non-dedicated equipment is the low flow pump. Sampling equipment will be constructed of inert material (e.g., stainless, Teflon®). For non-dedicated equipment, field decontamination will be performed prior to its initial use, between sampling locations and between actual samples when more than one sample is to be collected at a given location. All non-dedicated sampling equipment will be decontaminated according to the following procedure:



- 1. Wash equipment thoroughly with a low phosphate detergent (Alconox) and water using a brush to remove any particulate matter or surface film.
- 2. Rinse equipment with distilled water.
- 3. Rinse with diluted nitric acid (10%N).
- 4. Triple rinse with distilled water.
- 5. Air dry equipment.
- 6. Wrap equipment in a clean plastic sleeve or in aluminum foil if not used immediately.

Spent nitric acid will be contained in buckets or drums. After the groundwater sampling activities are complete, the containerized decontamination water will be sampled and disposed of properly.

6.7 FIELD SAMPLING DOCUMENTATION PROCEDURES

Field sampling operations and procedures will be documented by on-site personnel in bound field logbooks. Where appropriate, field operations and procedures will be photographed. Documentation of sampling operations and procedures will include documenting:

- Procedures for preparation of reagents or supplies which become an integral part of the sample (e.g., preservatives and absorbing reagents);
- Procedures for recording the exact location and specific considerations associated
 with sampling acquisition;
- Specific sample preservation method;
- Calibration of field instruments;
- Submission of field-based blanks, where appropriate;
- Potential interferences present at the Site;



- Field sampling equipment and containers including specific identification numbers of equipment;
- Sampling order;
- Decontamination procedures; and
- Field personnel.

Field logbooks will be waterproof and bound. The logbook will be dedicated to the job. No pages will be removed. Corrections will be made by drawing a single line through the incorrect data and initialing and dating the correction that was made to the side of the error. An initialed diagonal line will be used to indicate the end of an entry or the end of the day's activities.

6.8 SAMPLE CONTAINERS AND PRESERVATION

Table 3 lists the appropriated sample containers, preservation methods, and holding times for sample analysis. Samples will be labeled in the field according to the procedures outlined in Section 7.0 of this Attachment.

6.9 QUALITY CONTROL SAMPLES

Field QA/QC samples will be collected to determine if contamination of samples has occurred in the field and, if possible, to quantify the extent of contamination so that data are not lost. Duplicate samples, equipment blanks and matrix spike/matrix spike duplicate (MS/MSD) samples will be collected. The duplicate QC samples will be labeled with distinct identification locations and times, and submitted to the laboratory as regular samples. The actual identification of the duplicate QC samples will be recorded in the field logbook.



A summary of the field QA/QC samples to be collected during the sampling program are presented as follows:

- Equipment blanks consisting of laboratory supplied deionized water poured over sampling equipment;
- Duplicate samples for the samples sent for laboratory analysis; and,
- Matrix spike.

6.9.1 <u>Duplicate Samples</u>

Duplicate samples are independent samples collected in such a manner that they are equally representative of the sampling point and parameters of interest at a given point in space and time. Field duplicate samples provide precision information of homogeneity, handling, shipping, storage, preparation and analysis. Field duplicate samples will be analyzed with the original field samples for the same parameters.

Soil sample duplicates will be collected and homogenized before being split. Groundwater samples will be obtained by alternately filling sample containers from the same sampling device for each parameter. One of every twenty samples submitted for laboratory analysis will be duplicated.

6.9.2 Equipment Blanks

The equipment (rinsate) blank is designed to address cross-contamination between sample sources in the field due to deficient field equipment decontamination procedures. This blank also addresses field preservation procedures, environmental Site interference and the integrity of the source water for field cleaning.



An equipment blank will be prepared during sampling when a particular piece of sampling equipment was employed for sample collection and subsequently decontaminated in the field for use in additional sampling. Preservatives or additives will be added to the equipment blank where appropriate for the sampling parameters.

For soil sampling, the equipment blank will be composed in the field by collecting, in the appropriate container for water, a blank water rinse from the equipment (spoon, auger, corer, etc.) after execution of the last step of the proper field decontamination protocol. One equipment blank will be collected per 20 soil samples collected outside of HWMUs and sent to the off-site lab for lead analysis. One equipment blank will be collected per 20 soil samples collected inside of HWMUs and sent to the off-site lab for antimony, arsenic, cadmium, lead and selenium analysis.

For groundwater sampling, the sampling equipment will be filled with deionized water or deionized water will be pumped through the device, and transferred to the appropriate container for water. One equipment blank will be collected per 20 groundwater samples and sent to the offsite lab. During Containment Cell groundwater monitoring, the equipment blank will be analyzed for total and dissolved antimony, arsenic, and lead, pH and total organic carbon.

During the first two MNA events, the equipment blank will be analyzed for total and dissolved arsenic and lead, sulfide, sulfate, nitrate, arsenic speciation (arsenite/arsenate), iron speciation (ferric/ferrous), and manganese speciation (MnII/MnVII). After the first two MNA events, the equipment blank will be analyzed for total and dissolved lead and arsenic. Equipment blanks for dissolved metals will be filtered through a $0.45~\mu m$ filter prior to preservation.



6.9.3 Matrix Spike Samples

Where required by the SAP, a Matrix Spike/Matrix Spike Duplicate (MS/MSD) will be collected and analyzed for the same parameters as the parent sample. MS and MSD samples determine accuracy by the recovery rates of the compounds added by the laboratory (the MS/MSD compounds are defined in the analytical methods). The MS samples also monitor any possible matrix effects specific to samples collected from the Site and the extraction/digestion efficiency. In addition, the analysis of MS/MSD samples check precision by comparison of the two spike recoveries.

To ensure sufficient soil sample volume, MS/MSD sample locations shall have a second soil volume collected from the same diameter and depth interval as the parent sample immediately adjacent to the parent sample location. Both soil volumes will be placed into the same baggies, composited together and analyzed with the XRF before being placed into separate baggies. Each sample will be labeled with the sample number as the parent sample, designated as an MS/MSD sample, and submitted to the laboratory for the appropriate analyses. One MS/MSD sample will be collected for every 20 investigative and duplicate soil samples collected and sent to the off-site lab for analysis.

For groundwater samples, MS/MSD samples will be collected from the same location as the field sample and in the same manner. One MS/MSD sample will be collected for every 20 groundwater samples.

6.9.4 Field Blanks

Field blanks are collected during groundwater sampling by pouring demonstrated analyte-free water provided by the laboratory from one sample container into a preserved sample container



identical to those provided for sample collection. One field blank will be collected for each sampling round, and will be analyzed for the same parameters as the actual samples. Field blanks for dissolved metals will be filtered through a $0.45~\mu m$ filter prior to preservation.



7.0 SAMPLE CUSTODY

Sample identification and chain-of-custody shall be maintained for the work through the following chain-of-custody procedures and documentation:

- Sample labels, which prevent misidentification of samples;
- Custody seals to preserve the integrity of the sample from the time it is collected until it is opened in the laboratory;
- Field logbooks to record information about the site investigation and sample collection;
- Chain-of-Custody records to establish the documentation necessary to trace sample possession from the time of collection to laboratory analysis; and,
- Laboratory logbooks and analysis notebooks, which are maintained at the laboratory to record all pertinent information about the sample.

The purpose of these procedures is to ensure that the quality of the sample is maintained during its collection, transportation, storage and analysis. All sample control and chain-of-custody procedures applicable to the subcontracted laboratory will be presented in the laboratory's procedures.

7.1 CHAIN-OF-CUSTODY

A sample is in custody if it is in someone's physical possession or view, locked up or kept in a secure area that is restricted to authorized personnel.



7.1.1 Field Custody Procedures

As few persons as possible should handle samples in the field. The sample collector is personally responsible for the care and custody of samples collected until they are transferred to another person. The QA Representative will determine whether proper custody procedures were followed during field work and decide if additional samples are required.

7.1.2 Sample Labels

Identification labels are to be attached to the field sample containers. The labels shall not obscure any QA/QC lot numbers on the bottles. Sample information will be printed on the label in a legible manner using waterproof ink. The identification on the label must be sufficient to enable cross-reference with the logbook.

7.1.3 Chain-of-Custody

The chain-of-custody record must be completed by the person responsible for sample shipment to the subcontracting laboratory. All constraints on time and analytical procedures should be marked on the record. The custody record should also indicate any special preservation or filtering techniques required by the laboratory.

7.1.4 <u>Transfer of Custody and Shipment</u>

Chain-of-Custody records must be kept with the samples at all times. When transferring the samples, the parties relinquishing and receiving them must sign, date, and note the time on the record. Each shipment of samples to the laboratory must have its own chain-of-custody record with the contents of the shipment, method of shipment, name of courier, and other pertinent information written on the record. The original record accompanies the shipment and the copies



are distributed to the Project Manager. Freight bills, Postal Service receipts and bills of lading are retained as permanent documentation.

7.1.5 Custody Seals

Custody seals are adhesive-backed seals with security slots designed to break if the seals are disturbed. Seals are placed on all shipping containers, and seals shall be signed and dated before use.

7.2 SAMPLE DESIGNATION

Samples collected from each location, shall be identified by using a standard label which is attached to the sample container. The following information shall be included on the sample label:

Site name;

Date and time of sample collections;

Designation of the sample (i.e., grab or composite);

Type of sample with brief description of sampling location (depth);

Signature of sampler;

Sample preservative used; and

General types of analyses to be conducted.

7.2.1 <u>Proposed Sample Identification System</u>

The following sample identification system will be utilized to identify the location, type and depth of each soil sample collected. The soil removal area identification will match the designations shown on the design drawings and the grid location will utilize an alpha-numeric



designation developed by the QA Representative in consultation with the Contractor. Addition information will include depth of sample relative to pre-remediation ground surface.

Type of Sample	ID/Depth/Date
XRF Field Screening/Confirmation	XRF-FL4B/1.0-1.5-A5
Lab Analysis Confirmation	FL4B/1.0-1.5/A5
Duplicate	FL4B-D/1.0-1.5/A5
Stockpile Composite Sample	SP-1
Groundwater	CC-1 or MW-1

The results of all samples, including the XRF sampling results, XRF correlation samples, confirmation samples and duplicates will be entered into a computerized database. The database will be divided into sections labeled with each individual excavation identification and grid number and sub grid number.

7.3 SAMPLE HANDLING, PACKAGING, AND SHIPPING

Regulations for packaging, marking, labeling, and shipping hazardous materials are promulgated by the USDOT in the Code of Federal Regulations, 49 CFR 171 through 177. Samples obtained from the Site are anticipated to be environmental samples which are not expected to contain high levels of hazardous substances. Therefore, the shipment of samples designated as environmental samples are not regulated by DOT.

Samples collected by the QA Representative will be relinquished, directly to the laboratory, to the laboratory courier or shipped to the laboratories using the method described below. Environmental samples shall be packed prior to shipment by air using the following procedures:



Select a sturdy cooler in good repair. Secure and tape the drain plug with fiber or duct tape.

Allow sufficient outage (ullage) in all bottles to compensate for any pressure and temperature changes (approximately 10 percent of the volume of the container).

Be sure the lids on all bottles are tight (will not leak), and baggies are sealed.

Line coolers with minimum of two large trash bags. Place samples inside of lined coolers. Put ice (only required for groundwater sampling) on top of or between the samples. If soil samples in baggies are shipped with samples that require ice, those samples in baggies shall be double bagged to prevent infiltration of ice water into the soil sample. Pack samples securely to eliminate breakage during shipment. Tie off trash bags to seal.

Place chain-of-custody into a plastic bag, tape the bag to the inner side of the cooler lid and then close the cooler and securely tape (preferably with fiber tape) the top of the cooler shut. Custody seals should be affixed to the top and side of the cooler so that the cooler cannot be opened without breaking the seal.

A label containing the name and address of the shipper shall be placed on the outside of the container.

7.4 SAMPLE PRESERVATION AND HOLDING TIMES

When needed, sample containers will be obtained from the subcontracting laboratory and shall be prepared with a predetermined amount of preservative for each specified sample unless otherwise stated in the site specific field plan. A list of preservatives and holding times for each type of analysis are included Table 3 of this Attachment.



7.5 LABORATORY SAMPLE CUSTODY PROCEDURES

Once the sample arrives at the laboratory, custody of the samples will be maintained by laboratory personnel. Upon receipt of the samples, the sample receipt personnel will remove the chain-of-custody from the sealed cooler and sign and record the date and time on the chain-of-custody. The samples received will be verified to match those listed on the chain-of-custody. The laboratory will document and notify the sample generators QA Manager immediately if any inconsistencies exist in the paperwork associated with the samples. The laboratory at a minimum will document the following stages of analysis: sample receipt, sample extraction/preparation, sample analysis, data reduction, and data reporting.

Samples will be given a unique laboratory identification number and logged into the Laboratory Information Management System (LIMS). The analyst will enter the analytical data into the LIMS upon analysis completion and validation. The LIMS tracks the sample until completion of the report and invoice mailing. The data archived from the LIMS will be transferred to electronic storage format and retained for five years from the completion of sample analysis.



8.0 CALIBRATION PROCEDURES AND FREQUENCY

All instruments and equipment used during sampling and analysis will be operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations. Operation, calibration and maintenance will be performed by trained personnel on a daily basis. All maintenance and calibration information will be documented and will be available upon request.

Manufacturer's instructions for the XRF unit are provided in Attachment C.



9.0 LABORATORY QUALITY ASSURANCE PROGRAM

Samples will be analyzed by Test America in North Canton. The Test America quality assurance program is provided as Attachment A. The quality assurance program documents include the following:

- Title page;
- Table of contents;
- QA policy statement;
- Laboratory organization and responsibility;
- Sampling procedures and equipment;
- Sample custody;
- Data reduction, validation, and reporting;
- Performance and systems audit;
- Preventive maintenance;
- Corrective action; and
- Resumes.



10.0 DATA REDUCTION, VALIDATION AND REPORTING

10.1 DATA REDUCTION

All analytical data will be permanent, complete and retrievable. The analyst will enter the analytical data into the LIMS upon analysis completion and laboratory validation. The laboratory will report sample results on analysis report forms and provide the information referenced in the USEPA Methods for each deliverables package. All laboratory data will undergo the data validation procedures described in the Laboratory QA Manual prior to final reporting. Data will be stored on the laboratory's network until the investigation is complete and data archived from the LIMS will be transferred to magnetic tape which will be retained by the laboratory for an additional five years.

Results will be reported in micrograms per liter (ug/l) for aqueous samples or milligrams per kilogram (mg/kg) for solid samples. Equations to calculate concentrations are found in the SW-846 Method 6010B and 6020A. All blank results and QC data will be included in the data deliverables package. Blank results will not be subtracted from the sample results. The blank results and QC data will be used in data validation to review sample results qualitatively. Data validation will be performed for samples analyzed at the off-site laboratory in general accordance with the guidelines identified in Section 10.2. Outliers and other questionable data will be addressed in the data validation report and specific QA/QC flags will be applied to questionable data. The QA/QC flags will be consistent with the USEPA data validation guidelines.

All analytical data, reports, and any other project related information produced during this project will be stored in the project file at the sample generators office maintained by the Project Manager. Project reports, tables, etc. will be stored in project specific electronic files.



10.2 DATA VALIDATION PROTOCOL

Validation of analytical data as received from the off-site laboratory will be performed by an AGC QA Scientist. All data will be validated. Validation will be performed in general accordance with the following data validation guidance documents, where applicable:

- <u>National Functional Guidelines for Inorganic Data Review, Multi-Media, Multi-Concentration</u>. USEPA, February 1994.
- Region V Standard Operating Procedures for Validation of CLP Inorganic Data, USEPA, September 1993.

A detailed QA review will be performed on all data by the AGC QA Scientist to verify the qualitative and quantitative reliability of the data as it is presented. This review will include a detailed review and interpretation of all data generated by the laboratory. The primary tools which will be used by the AGC QA Scientist will be guidance documents, established (contractual) criteria, and professional judgement. The items that will be examined during the detailed QA review of data will consist of: sample results; analytical holding times; sample receipt condition, preservation, and cooler temperature; chains-of-custody; initial and continuing calibrations; CDRL standards; blanks (method, preparation, initial, continuing, and equipment; ICP interference check samples; surrogates; laboratory duplicates; field duplicates; internal standards; MS/MSD recoveries; laboratory control samples; serial dilutions; blank spikes; furnace QC components (post digestion spikes; MSA; correlation coefficients); GC/ECD instrument performance checks; target compound identification; and overall system performance. A typical data validation checklist is provided in Attachment B of the QAPP.



Based upon the detailed review of the analytical data, a data validation report will be prepared which will state in a technical, yet "user-friendly" fashion the qualitative and quantitative reliability of the analytical data. The report will consist of an introduction section, followed by qualifying statements that should be taken into consideration for the analytical results to best be utilized. Based on the QA review, qualifier codes will be placed next to specific sample results on the sample data tables, if necessary. These qualifier codes will serve as an indication of the qualitative and quantitative reliability of the data. Common qualifier codes include:

- "U" the analyte was not detected at or above the reporting limit;
- "J" the analyte was positively identified and detected; however, the concentration is an estimated value because the result is less than the reporting limit or quality control criteria were not met;
- "UJ" the analyte was not detected, the associated reporting limit is an estimated value:
- "R" data are rejected due to significant exceedance of quality control criteria.

 The analyte may or may not be present. Additional sampling and analysis are required to determine;
- "D" value was obtained from reanalysis of a diluted sample;
- "DJ" the analyte was positively identified and detected; however, the concentration is an estimated value because quality control criteria were not met and the value was obtained from reanalysis of a diluted sample;
- "B" not detected substantially above the level reported in laboratory or field blanks;
- "K" analyte present. Reported value may be biased high. Actual value is expected lower; and,
- "L" analyte present. Reported value may be biased low. Actual value is expected to be higher.



Once the review has been completed, the AGC QA Manager will verify the accuracy of the review and will then submit these data to the AGC Project Manager. The QA Manager or designated individual will check 100% of assigned qualifiers and other hand entered items. These approved data tables and data validation reports will be signed and dated by the AGC QA Manager.

10.3 DATA VALIDATION REPORTS

Data validation reports, along with copies of all support documentation, validated data summary tables, and analytical data packages, will be submitted periodically as data are validated. Reports will be held for the duration of the project plus 5 years, at a minimum.

10.4 DATA REPORTING

All data deliverables from each laboratory must be paginated in ascending order. The laboratory must keep a copy of the paginated package in order to be able to respond efficiently to data validation inquiries. Any errors in reporting identified during the data validation process must be corrected by the laboratory as requested. All data validation inquiries to the laboratory must be addressed by a written response from the laboratory in question. The data deliverable required for this project will include a case narrative, the sample results (Form 1s), blank data, MS/MSD percent recoveries and relative percent differences, laboratory control sample percent recoveries, and any other quality control data.



11.0 INTERNAL LABORATORY QUALITY CONTROL CHECK SAMPLES AND CALCULATIONS

All QC procedures employed by the laboratory will be, at a minimum, equivalent to those required in the specified analytical methods. Laboratory QC checks are accomplished through the analyses of laboratory blanks, calibration verifications, laboratory control standards and performance evaluation samples. When internal QC results fall outside method acceptance criteria, the data will be reported, and the analysis repeated, flagged or accepted according to the specified analytical methods. The following sections describe internal laboratory QC check samples.

11.1 LABORATORY BLANKS

Method blanks are generated within the laboratory during the processing of the actual samples. These blanks will be prepared using the same reagents and procedures and at the same time as the project samples are being analyzed. If contamination is found in the method blank, it indicates that similar contamination found in associated samples may have been introduced in the laboratory and may not have been actually present in the samples themselves. Guidelines for accepting or rejecting data based on the level of contamination found in the method blank are presented in the specified analytical method.

A minimum of one method blank per 20 samples will be analyzed or, in the event that an analytical round consists of less than 20 samples, one method blank sample will be analyzed per round.



11.2 MATRIX SPIKE/MATRIX SPIKE DUPLICATES

MS analyses are performed in association with metal analyses. MS are prepared by placing a known quantity of selected target analytes into a second aliquot of an actual field sample. The spiking occurs prior to sample preparation and analysis. The MS is then processed in a manner identical to the field sample. Recovery of each of the spiked compounds reflects the ability of the laboratory and method to accurately determine the quantity of that analyte in that particular sample.

11.3 LABORATORY CONTROL SAMPLE

The Laboratory Control Sample (LCS) is prepared by the laboratory by adding analytes of known concentrations to solution (DI water for metals analysis) for analyses. The LCS is prepared, analyzed and reported once per sample delivery group (SDG). The LCS must be prepared and analyzed concurrently with the samples in the SDG using the same instrumentation as the samples in the SDG. The LCS is designed to access (on a SDG-by-SDG basis) the capability of the laboratory to perform the analytical methods. If the analytes present in the LCS are not recovered within the criteria defined in the specified analytical methods, the samples will be reanalyzed or data will be flagged.



12.0 PERFORMANCE AND SYSTEM AUDITS

12.1 LABORATORY AUDITS

The purpose of a quality assurance audit is to provide an objective, independent assessment of a measurement effort. The quality assurance audit ensures that the laboratory's data generating, data gathering, and measurement activities produce reliable and valid results. There are two forms of quality assurance audits: performance evaluation audits and system audits.

12.1.1 Performance Evaluation Audits

The purpose of performance evaluation audits is to quantitatively measure the quality of the data. These audits provide a direct evaluation of the various measurement systems' capabilities to generate quality data.

The laboratory regularly participates in performance evaluation audits as part of their laboratory certification efforts. Performance audits are conducted by introducing control samples in addition to those routinely used.

The results of the performance audits are summarized and maintained by the Laboratory QA Supervisor and distributed to the section supervisors who must investigate and respond to any out of control results.

12.1.2 <u>Technical System Audits</u>

A technical systems audit is an on-site, qualitative review of the various aspects of a total sampling and/or analytical system. The purpose of the technical systems audit is to assess the overall effectiveness, through an objective evaluation, of a set of interactive systems with respect



to strength, deficiencies, and potential areas of concern. Typically, the audit consists of observations and documentation of all aspects of sample analyses. External and internal audits are conducted of the laboratory throughout each year.



13.0 PREVENTATIVE MAINTENANCE

13.1 FIELD EQUIPMENT

Field measurement equipment and the XRF unit will be maintained in accordance with manufacturer's instructions. All field equipment will be checked by qualified technicians prior to use in the field. The instrument operator will be responsible for ensuring that the equipment is operating properly prior to use in the field. Any problems encountered while operating the instrument will be documented in the field logbook. If problem equipment is detected or should require service, the equipment will be returned and a qualified technician will perform the maintenance required. Use of the instrument will not be resumed until the problem is resolved. Routine maintenance of field instruments will be documented in the field logbooks.

13.2 LABORATORY EQUIPMENT

Preventative maintenance and periodic maintenance is performed as recommended by the manufacturers of the equipment in use in the laboratory. Spare parts are kept in inventory to allow for minor maintenance. Service contracts are maintained for most major instruments, balances and critical equipment. If an instrument fails, the problem will be diagnosed as quickly as possible, and either replacement parts will be ordered or a service call will be placed.

Laboratory logbooks are kept by the laboratory to track the performance maintenance history of all major pieces of equipment. The instrument maintenance logbooks are available for review upon request. Specific details of preventative maintenance programs for the laboratory will be provided in the Laboratory QA Manual.



14.0 <u>SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY AND COMPLETENESS</u>

14.1 PRECISION

The precision of laboratory test results will be expressed as RPD or RSD. RPD is derived from the absolute difference between duplicate analyses divided by the mean value of the duplicates. The percent RSD is obtained by dividing the standard deviation by X. Equations for RPD and RSD are presented below:

$$RPD = |D1 - D2| \times 100$$

$$(D1 + D2)/2$$

Where:

D1 and D2 = the two replicate values

RSD =
$$\underline{S}$$
; and S = $[n (x_i - x)^2/n-1]\frac{1}{2}$
X

Where:

S = standard deviation

 x_i = each observed value

x = the arithmetic mean of all observed values

n = total number of values



14.2 ACCURACY

Accuracy will be calculated on the average percent recovery of spiked samples. Reference materials are essential to the evaluation of accuracy. Stock solutions for accuracy spikes and QC standards (if possible) shall be traceable to a source independent from the calibration standards. Accuracy is calculated using the following equation:

$$%R = \underline{SSR - SR} = 100$$
SA

Where:

%R = % R =

SSR = spike sample result

SR = sample result

SA = amount of spike

14.3 <u>DATA COMPLETENESS</u>

Completeness is evaluated by dividing the total number of verifiable data points by the maximum number of data points possible and expressing the ratio as a percent. A usability criteria of 90 percent has been set for this project. The equation used for completeness is presented below:

$$C (\%) = \underline{D} \times 100$$
$$P \times n$$



Where:

D = number of confident quantifications

P = number of analytical parameters per sample requested for analysis

n = number of samples requested for analysis



15.0 CORRECTIVE ACTION

When field sampling activities or laboratory QC results show the need for corrective action, immediate action will take place and will be properly documented. In the event that a problem arises, corrective action will be implemented. Any error or problem will be corrected by an appropriate action which may include:

- Replacing or repairing a faulty measurement system;
- Discarding erroneous data;
- Collecting new data; and
- Accepting the data and acknowledging a level of uncertainty.

15.1 FIELD SAMPLING CORRECTIVE ACTION

The on-site Principle Investigator will be responsible for all field QA. Any out of protocol occurrence discovered during field sampling will be documented in the field logbook and immediate corrective action will be taken. For problems or situations which cannot be solved through immediate corrective action, the Principle Investigator will immediately notify the AGC Project Manager. The AGC Project Manager and Principle Investigator will investigate the situation and determine who will be responsible for implementing the corrective action. Corrective action will be implemented upon approval by the AGC Project Manager. The Project Manager will verify that the corrective action has been taken, appears effective, and at a later date, verify that the problem has been resolved. The successfully implemented corrective action will be documented in the field logbook by the on-site Principle Investigator. Any deviations from the QA protocol in the SAP must be justified, approved by the AGC Project Manager (and IDEM and the USEPA, if necessary), and properly documented.



15.2 LABORATORY SITUATION CORRECTIVE ACTION

Corrective action will be implemented to correct discrepancies found which affect the validity or quality of analytical data, and to identify any analytical data that may have been affected. Limits of data acceptability for each parameter and sample matrix are addressed in the instrument manuals, USEPA Methods and/or Laboratory QA Manual. Whenever possible, immediate corrective action procedures will be employed. All analyst corrective actions are to be followed according to the instrument manuals, USEPA Methods, or Laboratory QA Manual. Any corrective action performed by the analyst will be noted in laboratory logbooks.

Laboratory personnel noting a situation or problem which cannot be solved through immediate corrective action will notify the Laboratory QA Supervisor. The QA Supervisor will investigate the extent of the problem and its effect on the analytical data generated while the deficiency existed. All data suspected of being affected will be scrutinized to determine the impact of the problem on the quality of the data. If it is determined that the deficiency had no impact on the data, this finding will be documented. If the quality of the analytical data were affected, the Laboratory Program Manager and the sample generator's Project Manager will be notified immediately so that courses of action may be identified to determine how to rectify the situation.

The laboratory must take corrective action if any of the QC data generated during the laboratory analyses are outside of the method criteria. Corrective action for out-of-control calibrations is to recalibrate the instrument and re-analyze the samples. A sequence is specified in the USEPA specified methods when problems in analyses are encountered. The laboratory will follow these procedures exactly and document the problems encountered and the corrective action in a case narrative enclosed with each data deliverables package.



The Laboratory QA Supervisor will be responsible for informing the Laboratory Program Manager and sample generator's Project Manager of the effects on the data, the data affected and the corrective action taken. It is also the Laboratory QA Supervisor's responsibility to verify that the corrective action was performed, appears effective, and at a later date, the problem was resolved.

15.3 DATA VALIDATION QA CORRECTIVE ACTION

Upon completion, sample data packages will be sent from the laboratory to the sample generator's QA Scientist for data validation. If all project samples are not present in the data packages or any deficiencies affecting the sample results are noted, the QA Scientist will contact the Laboratory QA Supervisor. The Laboratory QA Supervisor will respond in writing to any inquiries and provide any changes to the data packages to the QA Scientist. Any errors, problems, questionable data values, or data values outside of established control limits will be corrected by the appropriate action which may include disregarding erroneous data, collecting new data, and accepting the data and acknowledging a level of uncertainty. The data validation report will provide a description of the usability of the data.



TABLES

TABLE 1 SAMPLING PARAMETERS AND REPORTING LIMITS



RMC Beechgrove, Indiana

LOCATION	MATRIX	METHOD	PARAMETER	RL	DQO	UNITS
LOCATION	111111111111111111111111111111111111111	SW-846 6020A1	Antimony	0.2	37	mg/kg
	<u> </u>		Arsenic	1	20	mg/kg
HWMU			Cadmium	0.5	77	mg/kg
HWMO		SW-846 6010B1	Lead	0.3	970	mg/kg
ŀ			Selenium	0.5	53	mg/kg
outside HWMU, but	annanda I	SW-846 6010B ¹	Lead	0.3	920	mg/kg
still onsite Offsite	\	SW-846 6010B1	Lead	0.3	400	mg/kg
OHSIC	wann	SW-846 9045	pH	NA	NA	S.U.
		US EPA 2480D	eH	20	NA	millivolts
		SW-846 6020A	Antimony	0.2	37	mg/kg
		5 W-840 0020A	Aluminum	20	NA	mg/kg
			Arsenic	1	20	mg/kg
			Barium	20	NA	mg/kg
			Beryllium	0.5	NA	mg/kg
			Cadmium	0.5	77	mg/kg
			Calcium	500	NA	mg/kg
	1		Chromium	1	NA	mg/kg
	Soil/ Sediment		Cobalt	5	NA	mg/kg
			Copper	2.5	NA	mg/kg
			Iron	10	NA	mg/kg
		SW-846 6010B	Lead	0.3	970	mg/kg
Monitoring			Magnesium	500	NA	mg/kg
Well			Manganese	1.5	NA	mg/kg
Installation			Nickel	4	NA	mg/kg
	1		Potassium	500	NA	mg/kg
			Selenium	0.5	53	mg/kg
			Silver	1	NA	mg/kg
			Sodium	500	NA	mg/kg
			Thallium	1	NA	mg/kg
			Vanadium	5	NA	mg/kg
			Zinc	5	NA	mg/kg
		SW-846 7471	Mercury	0.1	NA	mg/kg
		US EPA 7063 mod	Arsenic speciation (arsenite/arsenate)	0.4	NA	mg/kg
	<u> </u>	SM 3500 Fe D	Iron speciation (ferric/ferrous)	0.5	NA	mg/kg
	 	Walkley Black	Total Organic Carbon	1000	NA	mg/kg
	 	SW-846 9056	Sulfate	10	NA	mg/kg
	<u> </u>	ASTM D422-63	Gradation (Sieve and Hydrometer)	NA	NA NA	NA

${\bf TABLE~1}\\ {\bf SAMPLING~PARAMETERS~AND~REPORTING~LIMITS}$

4

RMC Beechgrove, Indiana

LOCATION	MATRIX	METHOD	PARAMETER	RL	DQO]	UNITS
All Control	A CONTRACTOR OF THE PARTY OF TH	CNI 046 (010D	Total and Dissolved Lead	1	15	μg/L
Containment		SW-846 6010B	Total and Dissolved Arsenic	1	10	μg/L
Cell	Aqueous	SW-846 6020A	Total and Dissolved Antimony	2	6	μg/L
Monitoring	·	SW-846 9040	рН	NA	NA	S.U.
		SW-846 9060	Total Organic Carbon	1	NA	mg/L
		200 - 200 -	Total and Dissolved Lead	1	15	μg/L
		SW-846 6010B	Total Iron	50	NA	μg/L
			Total and Dissolved Arsenic	1	10	μg/L
		SW-846 9034	Sulfide	3	NA	mg/L
MNA	Aqueous	SM 4500 SO3 B	Sulfite	5	NA	mg/L
*****		US EPA 300.0	Nitrate	0.1	NA	mg/L
		US EPA 7063 mod	Arsenic speciation (arsenite/arsenate)	2	10	μg/L
		SM 3500 Fe D	Iron speciation (ferric/ferrous)	50	NA	μg/L
		Applied Speciated propriatary method	Manganese speciation (MnII/MnVII)	NA	NA	μg/L
**************************************	***************************************	SW-846 6020A ¹	Total and Dissolved Antimony	2	NA	µg/L
			Total and Dissolved Arsenic	1	NA	μg/L
			Total Cadmium	1	NA	μg/L
		SW-846 6010B1	Total Iron	50	NA	μg/L
			Total and Dissolved Lead	1	NA	μg/L
			Total Selenium	5	NA	μg/L
Equipment		SW-846 9040	рН	NA	NA	S.U.
Blanks	Aqueous	SW-846 9060	Total Organic Carbon	1	NA.	μg/L
Diamis		SW-846-9034	Sulfide	3	NA	μg/L
		SM 4500 SO3 B	Sulfite	5	NA	μg/L
		US EPA 300.0	Nitrate	0.1	NA.	μg/L
		US EPA 7063 mod	Arsenic speciation (arsenite/arsenate)	2	NA	μg/L
		SM 3500 Fe D	Iron speciation (ferric/ferrous)	50	NA	μg/L
		Applied Speciated propriatary method	Manganese speciation (MnII/MnVII)	NA	NA	μg/L

Notes:

Antimony will be analyzed by SW-846 6020A

μg/L: micrograms per liter

RL: Reporting Limit

mg/L: milligrams per liter

DQO: Data Quality Objective

mg/kg: milligrams per kilogram N/A: not applicable

 $^tUSEPA \ "Test\ Methods\ for\ Evaluating\ Solid\ Waste:\ Physical/Chemical\ Methods",\ Feb.\ 2007,\ SW-846,\ 6^{th}\ Revision.$



TABLE 2
DATA QUALITY OBJECTIVES
RMC Beechgrove, Indiana

DQO PARAMETER	LABORATORY PARAMETERS (aqueous)	LABORATORY PARAMETERS (soil/sediment)
<i>PRECISION</i> Matrix Spike	<20% RPD for results > 5*RL <±RL for results < 5*RL	<35% RPD for results > 5*RL <±2*RL for results < 5*RL
Field Duplicate	<30% RPD for results > 5*RL <±RL for results < 5*RL	<50% RPD for results > 5*RL <±2*RL for results < 5*RL
ACCURACY Laboratory Blank	-%L	<rl< td=""></rl<>
Equipment Blank	<rl< td=""><td><rl< td=""></rl<></td></rl<>	<rl< td=""></rl<>
Matrix Spike	80-120 %R unless sample concentration exceeds the spike added by a factor of 4 or more.	75-125 %R unless sample concentration exceeds the spike added by a factor of 4 or more.
Laboratory Control Sample	80-120 %R	80-120 %R
COMPLETENESS	%06	%06
COMPARABILITY	Based on precision, accuracy and media comparison	Based on precision, accuracy and media comparison

RPD: Relative percent difference. RL: Reporting limit %R. Percent recovery.



TABLE 3 SAMPLE CONTAINERS, PRESERVATIVES, AND HOLDING TIMES RMC Beechgrove, Indiana

	!						
NOM	XI OLL YES	METHOD	PARAMETER	CONTAINER	PRESERVATIVE	HOLDING	SAMPLE VOLUME
HWMU Areas	Š	SW-846 6010B ¹ SW-846 6020A (antimony)	Antimony, Arsenic, Cadmium, Lead, Selenium	zip lock baggies	none	6 months	5 grams
Non-HWMU	Soil/Sediment	S.	Lead	zip lock baggies	กดน	6 months	5 grams
Office Aleas	Contradition.	100102 200 700	bea. I	zip lock baggies	none	6 months	5 grams
Offsite Areas	Sourceanient	CVV.846 9045	Ho	2 oz WMG	попе	ASAP	10 grams
		11S FPA 2580D	Ha	8 oz WMG	none	попе	25 grams
Monitorine		SW-846 6010B SW-846 6020A	TAL metals	4 oz WMG or zip lock baggies	none	6 months 28 days (Mercury)	5 grams
Well	Soil/Sediment	(Antimomy)	A manic eneciation (accenite/arxenate)	4 oz WMG	none	28 days	5-10 grams
Installation		CM 3500 Fe D	Iron speciation (ferric/ferrous)	4 oz WMG	none	24 hours	10 grams
		Walkiew Black	Total Organic Carbon	4 oz WMG	попе	28 days	5 grams
		CW-846 9056	Sulfate	4 oz WMG	попе	28 days	50 grams
		ASTM D422-63	Gradation (Sieve and Hydrometer)	1 L WMG	none	auou	125 grams
		SW-846 6010B	Total and Dissolved Lead	TOO THEN	HNO ₃ pH<2; cool 4°C (total)	6 months	100 mL
Containment	4	SW-846 6010B	Total and Dissolved Arsenic	2000 mile more	cool 4°C (dissolved)		
Monitorine	choonby	CW-846 9040	Hu	250 mL HDPE	coal 4°C	ASAP	100 шС
		SW-846 9060	Total Organic Carbon	500 mL amber	H2SO4, cool 4°C	28 days	40 mL
		SW-846 6010B	Total and Dissolved Lead	500 mL HDPE	HNO ₃ pH<2; cool 4°C (total)	6 months	100 mL
		SW-846 6010B	Total and Dissolved Arsenic	Soo at timber	7n acetate/NaOH cool 4°C	7 days	100 mL
		SW-846 9034	Sulfite	250 mL HDPE	cool 4"C	ASAP	100 mL
		116 EDA 300.0	Nitrate	250 mL HDPE	cool 4°C	48 hours	100 mL
MNA	Acueous	115 EB & 7062 mod	A reanic energation (arcente/arcenate)	1 L. HDPE	HCI, cool 4°C	28 days	100 mL
		US EFA 1005 IRM	Tron eneciation (Ferric/Ferrons)	250 ml. HDPE	cool 4°C	24 hours	50 mL
		Applied Speciation propriatary	Manganese speciation (MnII/MnVII)	40 mL amber	cool 4°C	48 hours	40 mL
		SW-846 6010B ¹ SW-846 6020A (antimony)	Total Antimony, Arsenic, Cadmium, Lead, Selenium	500 mL HDPE	HNO, pH<2; cool 4°C	6 months	100 mL
		SW-846 6010Bl SW-846 6020A	Dissolved Arsenic, Antimony, Lead	500 mL HDPE	cool 4°€	6 months	100 mL
		CW-846 9040	Ha	250 mL HDPE	cool 4°C	ASAP	100 mL
,		3 W-846 9060	Total Organic Carbon	500 mL amber	H2SO4, cool 4°C	28 days	40 mL
Equipment	Aqueous	SW.846 9034	Suffde	500 mL HDPE	Zn acetate/NaOH, cool 4°C	7 days	100 mL
Blanks		SM 4500 SO3 B	Sulfite	250 mL HDPE	cool 4°C	ASAP	100 mL
		TIS EPA 300 0	Nitrate	250 mL HDPE	cool 4°C	48 hours	100 m.
		115 EPA 2063 mod	Arrenic special	1 L HDPE	HCl, cool 4°C	28 days	100 mL
		SM 3500 Fe D		250 mL HDPE	cool 4°C	24 hours	50 mL
		Applied Speciation proprietary	Manganese speciation (Mnll/MnVH)	40 mL amber	cool 4°C	48 hours	40 mL
		method					

¹USEPA "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods", Feb. 2007, SW-846, 6th Revision. HDPE- high density polyethylene WMG- wide mouth ginss jar ASAP - as soon as possiblo



ATTACHMENT C

XRF Manufacturer Instructions (Provided on CD)



ATTACHMENT B

Data Validation Checklist (Provided on CD)



ATTACHMENT A

Test America Laboratory SOP (Provided on CD)

1055 Andrew Drive, Suite A West Chester, PA 19380-4293 tel 610.840.9100 fax 610.840.9199 agc@advancedgeoservices.com www.advancedgeoservices.com

